

REMARKS

This paper is being presented in response to the non-final official action dated April 29, 2004, wherein: (a) claims 1-11 are pending; (b) all pending claims have been rejected under 35 U.S.C. § 103(a) as being obvious over Hung et al. U.S. Patent No. 6,380,096 B2 (the "Hung patent") in view of Huang et al. U.S. Patent No. 6,355,571 B1 (the "Huang patent"); and, (c) claims 1, 5, and 8 have been objected to due to informalities. Reconsideration and withdrawal of the rejections and objections are respectfully requested in view of the foregoing amendments and following remarks.

I. Brief Summary of the Claim Amendments

Claim 1 has been amended to provide proper antecedent basis for the term "sidewall." As amended, proper antecedent basis exists in claim 1 and, accordingly, the outstanding objection to claim 1 is rendered moot.

Claim 1 has been further amended to recite that "the cleaning process is implemented at a temperature of about 25°C - 50°C to minimize degradation of the interlay insulating film." Support for this amendment can be found in the specification at, for example, page 8, lines 5-8, and in claim 3 as originally presented. In view of the amendment to claim 1, claim 3 has been amended to omit recitation therein of the phrase "at a low temperature of about 25°C -50°C." Claim 1 also has been amended to recite that "the annealing process is implemented in two steps, the first step implemented to mitigate stress and detach OH radicals or H₂O residue absorbed on the sidewall of the aperture unit, and the second step implemented at a temperature higher than that of the first step to accomplish densification of interlay insulating film and the lower line." Support for this amendment can be found in the specification at, for example, page 8, lines 17-23, and in claim 5 as originally presented. In view of the amendment to claim 1, claim 5 has been amended to omit recitation therein of the phrase "wherein, the annealing process is implemented in two steps."

Pursuant to the examiner's suggestion, claim 8 has been amended to recite that "the cooling process is slowly implemented at a rate of 10 - 50°C/min." Support for this amendment can be found in the specification at, for example, page 7, lines 15-16. In view of the amendment, the outstanding objection to this claim has been rendered moot.

Because each of the claim amendments finds written description support in the application as filed, no new matter has been introduced by the foregoing amendments. Entry of the foregoing amendments and reconsideration of the outstanding claim objections are respectfully requested.

II. The 35 U.S.C. § 103(a) Rejection is Traversed

As noted above, claims 1-11 have been rejected under 35 U.S.C. § 103(a) as being obvious over Hung et al. U.S. Patent No. 6,380,096 B2 (the "Hung patent") in view of Huang et al. U.S. Patent No. 6,355,571 B1 (the "Huang patent"). See pp. 2-3 of the action. A response to the obviousness rejection is set forth below.

A. Proper Basis for a § 103(a) Rejection

To establish a prima facie case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine the teachings of a plurality of references. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all of the claim limitations. The teaching or suggestion to make the claimed invention and the reasonable expectation of success must both be found in the prior art, and not based on the applicant's own disclosure. *In re Vaeck*, 20 USPQ2d 1438 (Fed. Cir. 1991); see also M.P.E.P. § 2143 (8th ed. rev. 1, Feb. 2003).

The examiner bears the burden of establishing a prima facie case of obviousness and "can satisfy this burden only by showing some objective teaching in the prior art or that knowledge generally available to one of ordinary skill in the art would lead that individual to combine the relevant teachings of the references." *In re Fine*, 5 USPQ2d 1596, 1598 (Fed. Cir. 1988). To support a conclusion that a claimed combination is obvious, either (a) the references must expressly or impliedly suggest the claimed combination to one of ordinary skill in the art, or (b) the examiner must present a convincing line of reasoning as to why a person of ordinary skill in the art would have found the claimed invention to have been obvious in light of the teachings of the references. *Ex parte Clapp*, 227 USPQ 972, 973 (Bd. Pat. App. & Inter. 1985). It is "incumbent upon the examiner to identify wherein each and every facet of the claimed invention is disclosed in the applied reference." *Ex parte Levy*, 17 USPQ2d 1461, 1462 (Bd. Pat. App. & Inter. 1990) (citing *Lindemann Maschinenfabrik GmbH v. American Hoist and Derrick*, 221 USPQ 481, 485 (Fed. Cir. 1984)).

**B. No Prima Facie Case of Obviousness Has Been Made
and, therefore, the § 103(a) Rejection is Traversed**

The Hung and Huang patents **do not** teach or suggest all of the limitations recited in amended, independent claim 1 (and the claims dependent therefrom). Thus, no prima facie case of obviousness has been made in the instant action, and none exists based on the combination of the applied patents. Accordingly, reconsideration and withdrawal of the § 103(a) rejection are respectfully requested.

According to the action, the Hung patent — specifically, Figs. 1-12 and accompanying text at columns 1-16 — discloses the steps of cooling the semiconductor substrate in which the aperture unit is formed at a given temperature, and implementing an annealing/heating process *in situ* within a chamber in which the cleaning process is implemented. However, the Hung patent does not teach or suggest the step of cooling the semiconductor substrate in which the aperture unit is formed at a given temperature, as recited in amended claim 1.

Furthermore, the Hung patent does not teach or suggest the step of implementing a cleaning process using a hydrogen reduction reaction to remove polymer formed on a sidewall of the aperture unit and a metal oxide film formed on the lower line, wherein the cleaning process is implemented at a temperature of 25°C - 50°C to minimize degradation of the interlay insulating film, as recited in amended claim 1.

Still further, the Hung patent does not teach or suggest the step of implementing an annealing process *in situ* within a chamber in which the cleaning process is implemented, wherein the annealing process is implemented in two steps, the first step implemented to mitigate stress and detach OH radicals or H₂O residue absorbed on the sidewall of the aperture unit, and the second step implemented at a temperature higher than that of the first step to accomplish densification of interlay insulating film and the lower line, as recited in amended claim 1. (Indeed, the Huang patent also contains no such teaching or suggestion.)

The action acknowledges that the Hung patent does not teach the step of implementing a cleaning process using a hydrogen reduction reaction to remove polymer formed on a sidewall of the aperture unit and a metal oxide film formed on the lower line. See p. 3 of the action.

None of the foregoing missing teachings are remedied by the disclosure in the secondary reference, the Huang patent.

According to the action, the Huang patent — specifically, Figs. 1 and 2 and the text at columns 1-8 accompanying the same — teach the step of implementing a cleaning process using a hydrogen reduction reaction in order to remove polymer formed on a sidewall of the aperture unit and a metal oxide film formed on the lower line. See p. 3 of the action. Specifically, the Huang patent discloses that a step 306 (to introduce hydrogen containing plasma, strip oxide film) is conducted for approximately 5-60 seconds **at a temperature of 400°C**, a pressure of approximately 2.0-6.0 Torr, a substrate-to-showerhead spacing of 350 mils and RF power of approximately 50-500 watts and ammonia (NH₃) or hydrogen (H₂) gas flow of approximately 50-3,000 sccm and a nitrogen gas (N₂) flow rate of approximately 2,000-20,000 (see col. 5, lines 50-59). In contrast, amended claim 1 recites that the hydrogen reduction reaction is performed at a temperature of 25°C - 50°C to minimize degradation of the interlay insulating film.

A person having ordinary skill in the art, however, understands that if such a step is performed at a relatively high temperature of 400°C (as required according to the Huang patent's teachings), the interlay insulating film will be severely damaged by hydrogen. This problem is identified in the present application at page 2, lines 8-11, wherein it is noted that "the reactive cleaning process using hydrogen reduction has a problem that it causes surface damage in the low dielectric interlay insulating film containing carbon to degrade the dielectric characteristics of the interlay insulating film." Not only does the Huang patent fail to disclose the step of implementing a cleaning process using a hydrogen reduction reaction at a low temperature of about 25°C - 50°C to minimize degradation of the interlay insulating film, as recited in amended, independent claim 1, but the Huang patent also fails to provide a person having ordinary skill in the art with the requisite motivation to modify its teachings and reasonably expect success upon making the modification.

Given these shortcomings, it is respectfully submitted that no prima facie case of obviousness exists based on the combination of the applied patents, and that the subject matter recited in amended, independent claim 1 (and claims dependent therefrom) is unobvious. Accordingly, reconsideration and withdrawal of the § 103(a) rejection are respectfully requested.

CONCLUSION

In view of the foregoing, entry of amendments to claims 1, 3, 5, and 8, reconsideration and withdrawal of the rejections and objections, and allowance of all pending claims 1-11 are respectfully requested.

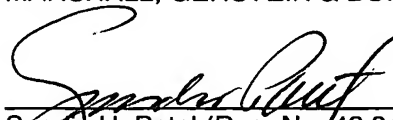
Should the examiner wish to discuss the foregoing, or any matter of form or procedure in an effort to advance this application to allowance, he is urged to contact the undersigned attorney.

Respectfully submitted,

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